JOURNAL OF THE EXPERIMENTAL ANALYSIS OF BEHAVIOR 1978, 30, 239-241 NUMBER 2 (SEPTEMBER)

MULTIPLE SCHEDULE COMPONENT DURATION: A RE-ANALYSIS OF SHIMP AND WHEATLEY (1971) AND TODOROV (1972)

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The tendency for relative response rate to approach matching as multiple schedule component duration decreases has been interpreted as confirming a prediction of Herrnstein's multiple schedule equation. However, the equation predicts that absolute response rate will decrease in both multiple schedule components as component duration decreases. The absolute response-rate data of two studies of component duration do not support this prediction; absolute rate either increased or remained relatively constant.

Key words: multiple schedules, component duration, matching law, key peck, pigeons

Herrnstein (1970) speculated that component duration in multiple schedules would affect the value of m (0 m 1), the interaction parameter of the two-component multiple schedule equation $R_1 = Kr_1/(r_1 + mr_2 + r_0)$. R_1 is the absolute response rate in one component, r_1 is the absolute reinforcement rate in that component, r_2 is the absolute reinforcement rate in the other component, and r_0 is the estimated absolute reinforcement rate for responses other than key pecking. K is the estimated asymptotic rate of responding. Figure 1 shows the predicted absolute response rates for a multiple VI 1-min VI 4-min schedule with K = 100 responses per minute, $r_0 = 8$ per hour, and m varying from 0.1 to 1.0. Also shown are the predicted relative rates for the VI 1-min schedule. As m increases, reflecting reduced component duration, the equation predicts that response rate will decrease in both components of the multiple schedule. Matching is approximated as m approaches 1.0 because relatively larger rate decreases are predicted for the higher-valued VI schedule. Other values of K and r_0 would not alter this general pattern of absolute rate changes.

Two investigations of the effect of component duration on multiple schedule response rates (Shimp and Wheatley, 1971; Todorov, 1972) have been interpreted as supporting Herrnstein's multiple schedule equation (de Villiers, 1974, 1976; Rachlin, 1973). Both of these studies found that relative response rate approached matching as component duration was shortened. This result was taken as verification that m increased to approximately 1.0 as component duration decreased. However, absolute response-rate functions from these two studies reveal that the results did not support Herrnstein's equation. Figure 2 shows how absolute response rate changed as component duration was varied. The data from Shimp and Wheatley are their Conditions 4 and 7 to 13 with averages taken over days and replications. Relative reinforcement rate was 0.80 ± 0.03. The data from Todorov are from the totals in his Table 1 with aver-

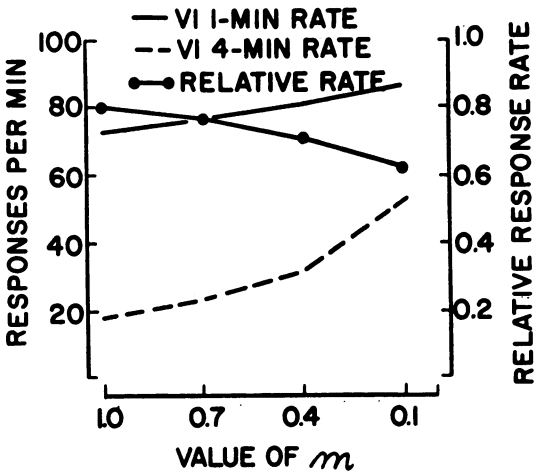

Fig. 1. Predicted absolute and relative response rates for a multiple VI 1-min VI 4-min schedule with K = 100 responses per minute, $r_0 = 8$ per hour, and several values of m. Relative rate is with respect to the VI 1-min schedule, which has a relative reinforcement rate of 0.80.

[1]The author wishes to thank Michael G. Grisham, Charles P. Shimp, and Edward A. Wasserman for reviews of the manuscript. Reprints may be obtained from Eugene L. Edmon, Department of Psychology, University of Iowa, Iowa City, Iowa 52242.

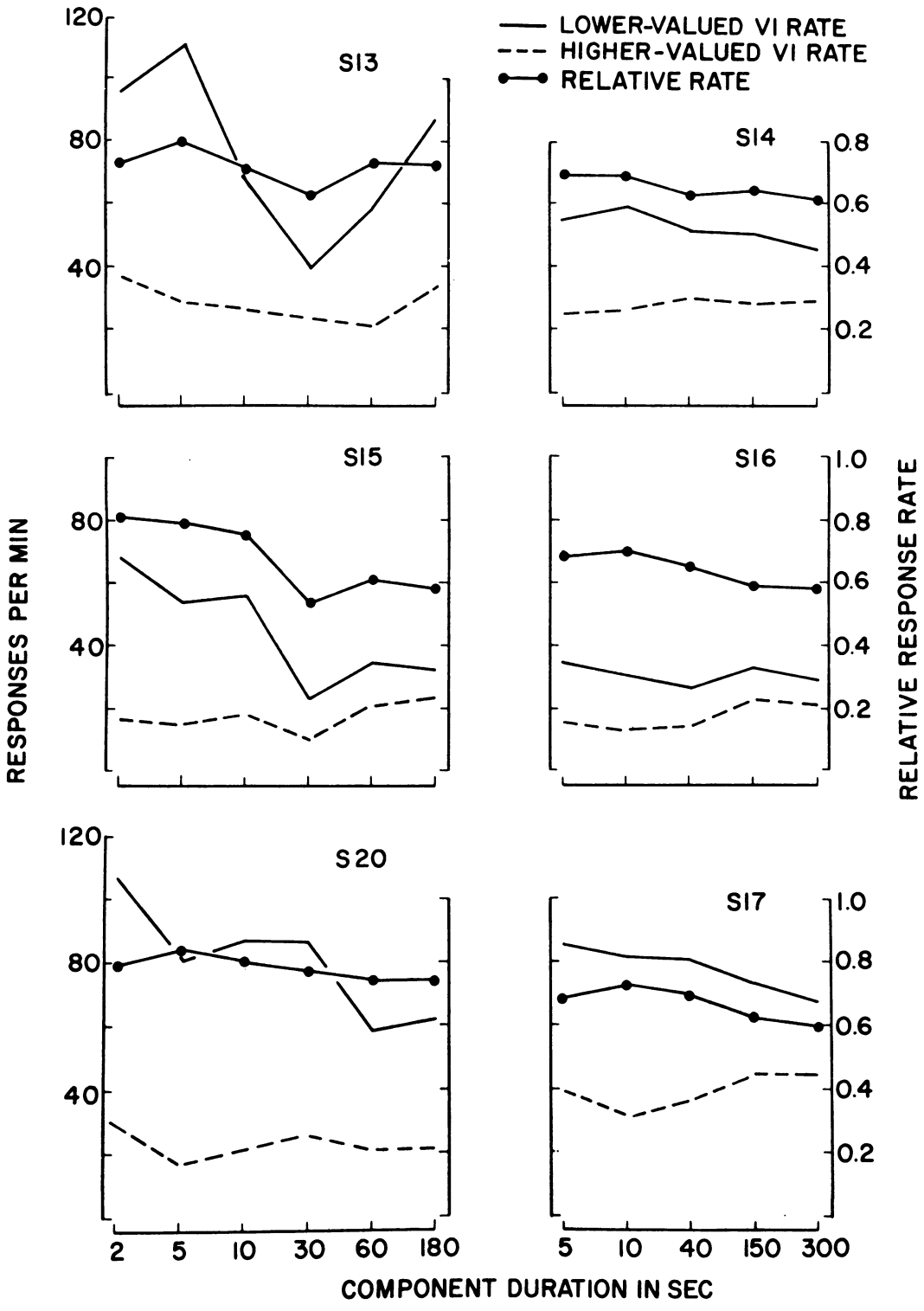

Fig. 2. Obtained absolute and relative response rates for various component durations. The left panels present data from Shimp and Wheatley (1971); the right panels present data from Todorov (1972).

ages over replications. Relative reinforcement rate was 0.75. Despite some differences in procedure between the two experiments, a consistent pattern was shown; as component duration decreased response rate on the lower-valued VI component schedule increased and rate on the higher-valued VI schedule remained relatively constant. Thus, although obtained relative response-rate changes were in agreement with those predicted, this is not a result of agreement between obtained and predicted absolute rates. Since the relative rate predictions of Herrnstein's theory are derived from the equation for absolute response rate, the data of Shimp and Wheatley (1971) and Todorov (1972) should not be taken as support for the multiple schedule equation.

As an alternative to Herrnstein's equation for absolute rates, consider one proposed by Davison and Hunter (1976) for concurrent schedules. Their equation, $R_1 = Kr_1^a/(r_1 + r_2)^a$, is consistent with the power function formulation of multiple schedule responding proposed by Lander and Irwin (1968). The exponent, a, is considered a measure of the sensitivity of responding to the distribution of reinforcement. As component duration decreases, a would tend toward 1.0 and matching of relative response rate to relative reinforcement rate would be approached. However, predicted absolute response rates from this equation show the same pattern as do those from Herrnstein's equation; as a increases, absolute schedule rates are predicted to decrease. As noted, the data do not conform to this pattern.

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Received 6 February 1978.
(Final acceptance 16 March 1978.)